

plan by means of submarine moorings, producing upward pressure and consequent steadiness, the immense momentum of such a floating mass, being 1500 feet long, and weighing 1500 tons, alone would protect it from being affected by minor forces. There would be no difficulty, however, in terminating the pier upon an abutment formed of boiler-plate chambers, filled with concrete or gravel, and being thus secured at both extremities, and inflexible laterally, would be perfectly rigid to all exterior forces save those sufficient to snap it from its moorings.

The above observations are intended to suggest the possibility of obtaining an unyielding principle in floating bodies which is so desirable in many instances, such as the crossing of estuaries, where it is impossible to erect rigid structures, owing to depth or badness of bottom; and although the subject is imperfectly considered in this paper, it is hoped that the principle started therein may yet be brought to bear practically, when necessity shall insist upon a departure from plans unsuited to extraordinary circumstances.

ART. V.—*Report II. of WILLIAM BLANDOWSKI, Esq. to the Honourable the Surveyor-General, on an Excursion to Frankston, Balcomb's Creek, Mount Martha, Port Phillip Heads, and Cape Shank.*

Camp at Western Port, 31st December, 1854.

ON the 20th November, 1854, I started on an excursion round the Southern coast, towards Cape Paterson; on my route I visited the mouth of the Mordialloc Creek, Frankston, Balcomb's Creek, Mount Martha, and Arthur's Seat, the Heads, Cape Shank, and Western Port.

I. The road runs nearly parallel with the coast, but between Melbourne and Frankston offers nothing worthy of particular observation.

The land is elevated about ten or twenty feet above the level of the sea, and in general is flat and sandy. Groups of very fine honeysuckle trees of an uncommonly large size are abundant near the shore, offering a shady retreat to the great funereal cockatoo (372, *Calyphlorhynchus funereus*) and patches of dense tea-tree scrub also impart a peculiar character to the coast.

The ford at the Mordialloc is difficult and dangerous to

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cross, as the quicksand at the mouth of the stream fixes the horses or dray at the least stoppage, and the animals, unable to obtain footing, refuse service.

About Frankston the coast rises abruptly to a height of two or three hundred feet above the level of the sea, and from that point to Arthur's Seat is well timbered with shea oak and other trees, which afford to the inhabitants of those districts a trade for supplying ships with firewood for Melbourne.

These trees all have an easterly inclination, proving the predominating winds to come from a west-south westerly direction.

The surface soil of this district is situated at some height above the sea, and consists of poor alluvial sand resting on tertiary sandstone.

Mount Martha and Arthur's Seat, the summits of which are elevated only about four hundred feet above the adjacent lands, form, together with Mount Eliza, the commencing points of three series of ranges, all pursuing an easterly direction. They are separated from each other by two large gullies, containing Hunter's and Balcomb's Creeks, and the Survey Flat, and decrease in magnitude eastwards, till at Western Port they are altogether lost.

Jameson's special survey, south of Mount Martha, consists of a low and in some places swampy plain; an excellent clay for the manufacture of bricks is here obtained, which some enterprising Americans have already turned to account, and erected a powerful engine, on a spot contiguous to the shore, to assist in their object.

Along the whole of Capel's Sound the coast is sandy, and the low banks facing the sea are covered with dense masses of tea-tree scrub.

With the "Whole Cliffs," or as they are better known to the population of the neighbouring districts, the "White Cliffs," begins the peninsula forming the Heads, and terminating in Point Nepean.

These cliffs rise to an altitude of about one hundred feet above the level of the sea, and are entirely formed of tertiary limestone and sand hummocks. The latter, which are very steep, are completely covered with a low and poor scrub, their appearance altogether being apt to suggest to the traveller the idea that Nature, so provident elsewhere in Victoria, has almost overlooked this part of the country.

A similar remark applies to the whole of the southern

coast, between the mouth of the Murray and Port Fairy, and to the immense tracts of land comprised under the term of the Mallee Scrub.

But even the desert character of this peninsula is counter-balanced by a circumstance which will tend to raise it to a place of some importance, I allude to the abundance of limestone found there, which is almost entirely absent near the metropolis. Coupled with this is the fact of its being situated in close proximity to the shores of the Bay, which thus renders it immediately available for the supply of Melbourne, and opens an advantageous field for the application of labour.

Approaching Cape Shank a series of wild and picturesque scenery everywhere meets the eye, that has so long rested on the monotonous shores of Port Phillip. Eastward from Point Nepean, and beginning with Cape Shank, the coast rapidly changes its physical character. Dark masses of basaltic rocks, forming wild cliffs, beetle two or three hundred feet above the level of the sea, and bring out in strong contrast the deep indigo blue of the ocean, whose mighty billows, crowded with white and glistening foam, roll in perpetual grandeur on the yellow sands of the beach. Along the tops of these hills the land is undulating, and forms conical hills diversified with steep gullies or basins, the sides of which are profusely timbered with shea oak. The rich basaltic soil near Barker's home station, the magnificent wood with which it is timbered, the numerous springs of excellent water abounding in the gullies, and also the facilities with which communication with Melbourne might be effected by the formation of a road to the Heads, constitute this part of the country a most favourable locality for colonisation by small farmers, and they would, moreover, be enabled to derive profit from various minor sources, such as supplying ships proceeding to sea, from the Heads, with vegetable products, the soil being, in my opinion, exceedingly adapted for the cultivation of fruits.

Between Tuck's and Halm's stations the soil is sandy, though occasionally diversified with patches of rich basaltic soil. This is the principal locality where saplings for telegraph posts are obtained.

Leaving Halm's station towards Dr. Adams', the coast assumes a low and sandy appearance, and consists generally of open plains covered with heath and light forest. The shores are composed of immense quantities of sea-weed,

covered by a light layer of sand, which makes them exceedingly difficult and dangerous to travel over on horseback.

Inland, between Mount Martha and Arthur's Seat, the country consists of low plains covered with heath and fern, and dense thickets of diminutive trees, chiefly stringy bark.

Oysters are obtained near King's station in great abundance, and about twenty or thirty men are already engaged in dredging for them, and obtain a good living by supplying Melbourne and Geelong, as well as the immediate neighbourhood.

I was informed by them that they forward on an average throughout the year three or four hundred oysters per day for each man, and they are sold on the spot to the traders and people in the neighbouring stations at 6d. per dozen.

II.—The country between Frankston and Balcolm's Creek is more or less composed of feruginose sandstone, belonging to the upper tertiary formation, and formed during the period of basaltic eruption. It consists of the following strata, beginning with surface soil, and continuing down to the basalt. I found these strata strikingly exhibited on the shore of the Bay, between Snapper Point and Balcomb's Creek,

No. 1. Alluvial soil of a deep grey colour, sandy and impregnated with vegetable matter. It varies from two to three feet in thickness, and forms a soil on which shea oak, as well as other trees, and especially coast plants, thrive luxuriantly.

No. 2. Shells. Immediately below this soil occur large quantities of marine shells, precisely similar in form to those at present found alive in Port Phillip Bay. Although still partly retaining their original colour, and being neither petrified nor impregnated with gypsum or calcium, they are all more or less broken and reduced into fragments, and are seldom to be obtained in a perfect state. This circumstance I think proves the oceanic action to have been very violent during the first igneous outbursts which raised our present coast. This layer of shells varies from one to two feet in thickness.

No. 3. A layer of sandy white clay, contrasting strongly with the intense red colour of the lower strata. It varies from ten to twelve feet in thickness, and its nature is such as to resist to a surprising degree the abrasing influence of the sun, wind, and rain; a great many cavities, however, are washed out of the stratum, and this imparts to it a rather

picturesque appearance, strongly resembling at a distance, and during sunshine, a miniature representation of the Alps.

No. 4. A red clayey sand, sometimes amber yellow and marbled. This stratum varies from ten to fifteen feet in thickness, but presents no peculiarities worth noticing.

No. 5. A layer of sand of a dark brown or red, or occasionally a pink colour.

This stratum varies from ten to fifteen feet in thickness.

No. 6. A hard sandstone of a dark brown or chocolate colour, occurring in a stratum of from twenty to fifty feet in thickness. The particles of quartz of which it is composed are cemented by oxide of iron. This sandstone in some places entirely changes its character, the cementing material being clay instead of oxide of iron, which imparts to the stratum a totally different appearance.

This latter sandstone, of a grey colour, lies about four or five feet above the level of the sea, and evidently contains fossil vegetable remains. It appears from this fact that this stratum, after forming the surface soil of a former epoch, was submersed, but subsequently again made its appearance above the sea. The fact of it still rising is, I think, proved by the existence of the shells described in No. 2, and the fossil remains subsequently enumerated in No. 7.

At one place I found the stems of trees, about one foot in diameter and from ten to fifteen feet in length, jutting out from the sandstone banks on a level with the sea.

The substance of these remains is identical with lignite, and although not here of very good quality, will, if found in greater quantities, perhaps become valuable as a substitute for coal.

The same formation I am well aware occurs in Flemington, St. Kilda, and Brighton, and I have also personally observed its existence at the Onkaparinga, on the coast of South Australia. At the latter place it exhibits precisely the same appearances as in the locality now under consideration. While speaking on this subject I may also mention that in South Australia no natural indications are found by which to estimate the comparative ages of these strata, since no basalt has been discovered near the spot, and even in the low lying clay strata there are remains of marine shells of kinds, no description of which has yet been published.

No. 7. A tough blue clay with layers of spheroidal masses of clayey limestone, containing multitudes of fossil remains, similar to the sphaerosiderite, imbedded in the clay deposits

of the Polish jura or oolite formation, near the Prussian silesian boundary.

These curious rounded blocks of limestone vary in size from one foot, and even less, to four feet in length, their thickness being from six to twelve inches. They are imbedded in two or three layers, one above the other, and are scattered throughout these strata as well singly as in groups. The settlers have not inappropriately compared them to dampers, by which name they are generally known.

I also found in the same stratum iron pyrites and sulphur of lime or gypsum. The gypsum occurs in spear-formed crystals, about three inches in length, and is in form quite distinct from that found by me at Batman's Hill, near Melbourne.

The fossil remains in the limestone exhibit precisely the same forms as those of the blue clay. The shells in the clay are, however, neither impregnated with calcium nor any other foreign substance, and very easily broken, or rather crumbled into fragments, whereas the shells in the limestone are beautifully petrified. Those palæontological remains consists of mitra, crepidula, murex, conus, voluta, cypracidæ, siliquaria, lunulites, cyrobranchiata, patellidæ, fungia, pecteri, terebratula, megalodus, cytherea, limopsis, spongia, retepora, thamniscus, tabellum, andonea, cellopora, and nautilii, all in a most perfect state of preservation.

I can only account for the total absence of all indications of cray fish and teeth of fishes amongst these remains by supposing that the prompter volition and motion of these animals preserved them from becoming imbedded in the clay.

Having taken a summary glance over the whole of the strata mentioned in the foregoing pages, I am of opinion that they form the sides of a clay basin belonging to the upper tertiary formation, and coeval with the uppermost strata of the London, the Paris, Vienna, and different Italian clay basins.

This particular spot, near Mount Martha, being at that period a favourable locality for the production of the different species of shell fish above enumerated, will explain its richness in fossil remains, and it is worthy of notice that a little further along the coast, southwards from Arthur's Seat, there is a spot remarkable for the great numbers of oysters and pectens, and abundance of minute shells which strew the beach.

The clay basin before mentioned is interrupted in two

places by the basalt. In one of these places the basalt occurs in horizontal platforms, which could easily be mistaken for stratifications.

These platforms are crossed in a perpendicular direction, by a network of iron ore (*Thoneisentein*), which completely disconnects them from each other. The meshes of this network are about six feet apart, and from six or eight inches in thickness.

The iron ore mentioned in the preceding paragraph is of greater interest than might at first appear. It is formed by a combination of aluminum and iron of good quality, there being more than thirty per cent. of the latter. When fresh broken it is of an ash grey colour, but after being exposed to the action of the atmosphere and the sea, assumes a clear brown colour, resulting no doubt from the oxidation of the iron, and traceable in all the fissures of the rock.

I would account for the origin of the sandstone described in No. 6 by supposing the iron just mentioned to have been partly washed away by the waves of the sea, when from its greater specific gravity, it would immediately seek the bottom, and by oxidising and cementing the sand, so formed the sandstone referred to.

I have reasons for believing this sandstone to have risen very rapidly above the surface of the sea from the following fact.

Between the basalt and sandstone in question occurs a greyish stone, which is in reality nothing else than partly decomposed and metamorphosed basalt or dolerit, although not readily recognised as such. It is in fact a mass of the same species of rock as that cut out from the site of the Exhibition Building in Latrobe street, and King street, near the Flagstaff, Melbourne, and which many are inclined to take for pipeclay. It was not until my arrival at the locality of which I am now speaking, and until I had an opportunity of there observing a similar mass, that I was enabled to form a correct judgment of the true nature of this peculiar rock. The gravel found above it at the Exhibition site is identical with the stratum described in the latter part of No. 6.

A few chains south-west from this point (between Balcomb's Creek and Snapper Point) lie two small islands or reefs at a short distance from the shore. At low tide they are about one foot above the sea, and are the resort of hundreds of white-bellied shags (613 *Phalacrocorax leucogaster*), and Bass's Straits fern (562, *Thalasseus polycercus*)

that retire thither to digest undisturbed their rich and abundant food.

These islands consist of regular pentagonal basaltic columns, the sides and bases of which are cemented by oxide of iron. The regularity of these columns imparts considerable interest to the islets, which is still further enhanced by the large numbers of birds frequenting them.

It was during the period which produced these basaltic columns that the coast of the bay was raised to its present level. In support of the opinion that this was effected very rapidly and at a comparative recent date, I will here adduce following strong reasons:—

First. The shells found on the surface (*vide* No. 2) have scarcely yet lost their original colour. The question here arises how long a time the decomposing power of the atmosphere and of other chemical causes, would occupy to effect the discolouring of these shells? If this were well ascertained the rising of the coast during any portion of time could be approximately estimated.

Secondly. The vast numbers of plants which only thrive in the immediate vicinity of the sea, and are now found on the plains about one hundred feet above the level of the sea, and the fact that brackish water soaking through the superincumbent strata, its saltness increasing as the altitude diminishes.

And, thirdly, the shells found in the lower strata on the beach, which are originally inhabitants of the deep seas only, but are now raised about four or five feet above the level of the Bay.

This hypothesis is further supported by the fact that the limestone at the Heads is arranged in three distinct strata, of which the lower and upper occur in thin horizontal layers, both of equal thickness; while the middle stratum exhibits an abrupt dip eastwards about 40 or 45 degrees.

This cannot be explained in any other way than by supposing the coast, in its gradual formation, to have received a sudden and violent check from some internal cause, which made the stratum sink at certain points. At this period a new horizontal layer was formed on this inclined strata; but by a second convulsion, both being raised, the primary stratum was again disposed horizontally, and the second inclined at the angle at which it at present occurs. Eventually, during a third period, another stratum was laid horizontally on the inclined substratum, and the whole were subsequently

raised bodily from the bed of the ocean, and assumed the appearance which they now present. The last layer constitutes the present surface soil.

The limestone here mentioned constitutes the whole of the South Australian coasts, and as its extent is so considerable, I will endeavour to fix its character, by presenting a detailed description of all the different forms under which I have observed it.

No. 1. A fine grained limestone without any fossil remains; of a light cream colour, with here and there a small hollow or cavity, containing the bones of lizards and birds; not petrified, nor yet completely destroyed.

Guano, of very fair quality, is found in these cavities; and I may here express my belief, on sundry grounds, that it exists in considerable quantities along the southern coasts.

This limestone occurs in blocks, of one or two feet in thickness, and is admirably adapted for the use of lime-burners. I mention this circumstance, as it might be the means of affording subsistence to hundreds of industrious men, a few being already engaged in this branch.

No. 2. A layer of limestone in curious and interesting forms, which have not inappropriately been compared to a forest on a hill side. The trees appear in some places to have had their tops lopped off by a hurricane. The roots and stems are most perfect resemblances; the latter, in many places, being hollow, but nowhere exceeding eighteen inches in diameter; and I would carry the mere comparison much further by asking whether the forest, being buried beneath the sea, and completely impregnated with calcium, could leave any other remains of its previous existence but the bare forms of the trees? The roots and crooked stems of these fac-similes resemble those of Mangrove trees.

They are far too irregular and ramified in their appearance to be taken for stalactites alone.

No. 3. The limestone already mentioned as formed during three different periods, is entirely composed of minute fragments of shells. It splits easily into large sheets, and is used in Melbourne for building purposes.

Cape Shank is formed of basalt, of a very deep colour, containing a large quantity of olivine and anguite. In some places it is impregnated with carbonate of strontium and carbonate of calcium, to so great an extent as to become perfectly amygdaloidal.

The following fact is somewhat remarkable. The basalt

occurs in clusters of irregular columns, varying in height from 40 to 50 feet, and decreasing in thickness from the top to the bottom, till, at a certain point, a little above the sea level, their traces are altogether lost in the stratum forming the basis. It appears to me probable that some terrestrial magnetic agency was the original cause of inducing action in the crystalizing power of the mass, from which these columns were produced.

IV. Of birds and animals, &c., I have little to say, as much experience and careful observation are required to ascertain their habits, modes of living, and other details connected with them. Upon these subjects my remarks are therefore as yet very limited.

During the month of October, nearly all the birds of Victoria lay their eggs; November is the building and moulting season; in December the young broods are hatched, and speedily begin to exercise themselves in short flights.

At this season birds are not very plentiful, except in the scrub, and near water holes; in places sheltered from the intense heat of the sun: being moreover extremely shy, they are with difficulty obtained.

The stubble quail (452, *Coturnix pectoralis*), perhaps forms an exception to the rule mentioned at the head of this section, since it appears to lay its eggs throughout the whole of November and December. These birds spend the greater part of the day in sleeping and basking in the sun, and they are not easily startled till the sportsman has arrived within arms' length of the place where they are sitting, when suddenly taking wing with a loud rustling noise, they so surprise him as often to elude his utmost vigilance.

In the breeding season the crows (269 *Corvus coronoides*) retire from the neighbourhood of the squatters' station into the mountain ranges. In these retreats they live principally on insects, chiefly obtained beneath the dung found about cattle camps.

During December the young magpie (90 *Gymnorhina organicum*) begins to fly, and is first taught by the old ones to utter the sonorous gurgling noise so peculiar to these birds; but which, however, during their first rude essays, is far from being melodious.

The well known lorries (384 *Platycercus pennantii*) are, during these months, in beautiful plumage. The young of these birds do not make their appearance until the latter end of December.

The different wood swallows (68 *Artamus sordidus*) (72, *Artamus personatus*), masked wood swallow (73, *Artamus superciliosus*), white eyebrowed wood swallow, associate without distinction of species, in groups of several hundreds, and in the beginning of December exercise their young in flying at a vast altitude.

The ground thrush (254, *Cinclosoma functatum*) moults in December, at a later period than most of the other birds. This bird is remarkable for its quick motion on the ground amongst the thick grass, exhibiting almost the habits of the grallinae. This thrush possesses the smallest wings, in proportion to the size of its body, of any known land bird: thus if the proportion between the wing and the body of any other bird be expressed by 1. 1. 72, or 1. 1. 80., which is a fair average, that of the ground thrush will be represented by the ratio 1. 1. 47.

In December the forests resound with the harsh guttural cry of the common wattle bird (306, *Anthochaera carunculata*), resembling the words "Jacob, Jacob, Jack," the young being about that time taught to imitate it.

The first breeding season having expired, the little stringybark parrakeet (415, *Trichoglossus pusillas*), again renews its affection to the female. It is then easy to approach. The same remark applies also, though in a less degree, to the blue mountain parrot (409, *Trichoglossus swainsonii*.)

During these months the New South Wales oriole (263, *Oriolus viridus*), may be observed flying singly through the woods, uttering its solitary and monotonous note.

The young of the golden eagle (1, *Aquila fucosa*), or eagle hawk of the colonists, have, at this period, arrived at full maturity, and find ample sustenance by preying upon the young broods of birds which, at this season, are so abundant.

The summer birds (99, *Grauculus melanops*) assemble in groups of three or four in the denser parts of the forest, and appear to live in perpetual enmity with every bird around them. They are constantly obliged to defend themselves against the attacks of the magpie, and several species of smaller birds.

The cuckoo is, at this season, very plentiful, its shrill note being heard in every part of the forest. Of these birds I have noticed a great number of different species (338, *Circulus inornatus*, unadorned cuckoo), (340, *Circulus inoperatus*, brush cuckoo.) I have frequently observed the bronze cuckoo (342, *Chysoccyx lucidus*) being fed by several smaller

birds, of a species of which I have not yet been able to procure.

The young of the laughing jackass (57, *Dacelo gigantea*) become fully matured about the middle of December, and make the woods re-echo with their loud and well-known cries.

The black cockatoo (372, *Calyptorhynchus funereus*) is extremely shy and wary. In November it first exercises its young in flying, and teaches them to be on their guard against their almost constant enemy, man.

The beautiful "budgerr gaw" (405, *Melopsittacus unclulatus*) is, at this season, extremely plentiful, the immigration from the warmer climates having just taken place. This bird, which is indeed an ornament to the country, frequents the low lands near the sea, and can be checked in its flight by the utterance of a peculiar cry. They are very easily obtained, as they are not afraid of the approach of the sportsman; and, moreover, by gathering in thick groups, offer an excellent shot. It used to be commonly believed by the colonists that these parrots were to be found in South Australia only, but nothing could be more erroneous.

III. Reptiles.—The slow or blind worm (*Egernia cunninghami*) belonging to the genus, *anguis*, is very closely connected with a species found throughout the whole of South Australia, and known to the settlers of those parts by the more appropriate title of the sleeping lizard. The body and tail are, however, of a more cylindrical form than those of the species referred to. The scales are also more smooth and glossy; those situated on the upper part of the head consist of five plates, each of which is divided from the other by a pair of lateral plates, of which the edges meet in the central and longitudinal line of the head. Six other pair of irregular shapes, and forming various sided polygons, surround the central plates, and protect the head of the animal with an almost impenetrable coat of mail.

The tongue and mouth are of a bright violet blue colour; the former, at its extreme point, is slightly cloven. The teeth, none of which are situated on the palate, are very minute. The jaws are very powerful in proportion to the size of the animal; and as it is commonly believed that they are perfectly harmless, I may here mention a circumstance which occurred to me in South Australia.

Having discovered a slow worm basking in the sun, and feeding on some yellow flowers, I handled the animal at first

gently, and then more roughly, without its making the least attempt to bite me. It constantly, however, thrust out its brilliant tongue to terrify me by its venomous appearance, and upon forcing a stick of about an inch in thickness into its mouth, it bit furiously into it, that I lifted it up by the stick, and retained it in that position several minutes before it released its savage grip. The impression left upon the stick was such as could have been produced only by the exertion of great muscular power. The body of this animal is of a pale yellowish grey colour, and is marked with black irregular stripes, crossing it in a slanting direction. The legs are disproportionately small to the size of the animal, being scarcely powerful enough to enable it to move along the ground; and it is, on this account, an easy prey to the attacks of the dingo, which feeds upon it. The tail also, compared to the size of the body, is remarkably short.

The snake changes its skin in December. The way in which this is really effected, will, I am afraid, without a long course of careful observation, remain but very obscurely known. The skin becomes, I believe, first detached from the flesh in the inner portions of the lips, and turns outward over them without bursting. The animal then pushes its head through the opening thus formed by the dead skin, and by dint of some exertion, eventually casts it off altogether.

V.—Quadrupeds.—Kangaroos (34, *Macropus major*) are extremely plentiful between Frankston and Cape Shank, individuals of an uncommonly large size being sometimes observed.

I am assured by inhabitants of these districts that kangaroos of a white, or very light colour, have occasionally been seen, and even obtained; but I may be allowed to withhold my full credence to these reports, till I have myself received ocular demonstration of their correctness.

These animals are frequently observed about midday asleep on the ground, in large groups, like flocks of sheep; and a horseman can often approach within a very short distance of them without being perceived. The oldest individuals are the most vigilant, and when a group are thus surprised, are the first to take alarm. Rising on his haunches, one of these "old men," as they are termed, listens attentively, to ascertain the direction from which the warning noise proceeded; then selecting that most favourable for their rapid retreat, he makes a few short leaps, and again